WE CLAIM:-

1. A method of routing an information packet over a label switched path between first and second end stations in a virtual private network defined over a communications network arrangement comprising a hierarchical arrangement of first, second and third levels of routers, the method comprising attaching to the information packet at a network edge a sequence of first, second and third labels indicative of a corresponding concatenated sequence of label switched path sections within the virtual private network, each said path section extending between a pair of said routers.

2. A method as claimed in claim 1, wherein each said virtual private network is defined by a network of quality of service capable tunnels each disposed between a respective pair of routers.

3. A method as claimed in claim 3, wherein said second level routers each perform an implicit switching function between the first level and third level routers.

4. A method as claimed in claim 3, wherein said label switched path sections are incorporated in dynamic multiplexed label switched paths comprising first-stage and second-stage Layer 1 constraint-based routed label switched paths.

5. A method as claimed in claim 4, wherein a new session is multiplexed onto a said dynamic multiplexed label switched path only if the resource constraints of the first-stage and second-stage constraint-based routed label switched paths are satisfied.

6. A method as claimed in claim 5, wherein the resource availability of the second-stage constraint-based routed label switched paths is advertised periodically to the first-stage constraint-based routed label switched paths, and wherein the resource availability is used to determine path selection

7. A method as claimed in claim 6, wherein the labels defining the sequence of tunnels are assigned during tunnel establishment.

8. A method as claimed in claim 7, wherein the labels defining the sequence of tunnels each identify a respective tunnel by means of a label switched path identifier.

5   9. A method of routing information packets over a label switched path in a communications multi-service network comprising; a plurality of nodes interconnected via quality of service capable tunnels and incorporating a frame-mode label switched (MPLS) architecture, wherein end-to-end communications having a predetermined quality of service are provided by defining at the network

10   edge a label stack of first, second and third labels for delivering packets through a sequence of said tunnels defined by the label stack.

10. A method as claimed in claim 9, wherein said tunnels are established as label switched path sections incorporated in dynamic multiplexed label switched paths

15   comprising first-stage and second-stage Layer 1 constraint-based routed label switched paths.

11. A method as claimed in claim 10, wherein a new session is multiplexed onto a said dynamic multiplexed label switched path only if the resource constraints of

20   the first-stage and second-stage constraint-based routed label switched paths are satisfied.

12. A method as claimed in claim 11, wherein the resource availability of the second-stage constraint-based routed label switched paths is advertised periodically to

25   the first-stage constraint-based routed label switched paths, and wherein the resource availability is used to determine path selection

13. A method as claimed in claim 12, wherein the labels defining the sequence of tunnels are assigned during tunnel establishment.

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14. A method as claimed in claim 13, wherein the labels defining the sequence of tunnels each identify a respective tunnel by means of a label switched path identifier.

35   15. A method as claimed in claim 14, wherein a session established on a said dynamic multiplex constraint based label switched path is identified by the third-layer label.

16. A method as claimed in claim 15, wherein a bandwidth allocation mechanism is used to pre-allocate, on a predictive or as needed basis, capacity within the second-stage Layer 1 constraint-based routed label switched paths such that dynamic multiplexed label switched path selection is deterministic.

17. A communications multi-service network comprising; a plurality of nodes interconnected via quality of service capable tunnels and incorporating a frame-mode label switched (MPLS) architecture, wherein end-to-end communications having a predetermined quality of service are provided by defining at the network edge a label stack of first, second and third labels for delivering packets through a sequence of said tunnels defined by the label stack.

18. A communications multi-service network incorporating a plurality of dynamic multiplex constraint based label switched paths defining quality of service capable tunnels, each said path comprising a second layer constraint based label switched paths constrained within two first-layer constraint based label switched paths.

19. A communications network as claimed in claim 18, wherein a said dynamic multiplex constraint based label switched path has no explicit traffic contact but is constrained entirely by the of its first layer paths.

20. A communications network as claimed in claim 18, wherein a new session is capable of being multiplexed onto a said dynamic multiplexed label switched path only if the resource constraints of the first-stage and second-stage constraint-based routed label switched paths are satisfied.

21. A communications network as claimed in claim 20, wherein the resource availability of the second-stage constraint-based routed label switched paths is advertised periodically to the first-stage constraint-based routed label switched paths, and wherein the resource availability is used to determine path selection

22. A communications network as claimed in claim 21, wherein the labels defining the sequence of tunnels are assigned during tunnel establishment.

23. A communications network as claimed in claim 22, wherein the labels defining the sequence of tunnels each identify a respective tunnel by means of a label switched path identifier.

24. A communications network as claimed in claim 23, wherein a session established on a said dynamic multiplex constraint based label switched path is identified by the third-layer label.

25. A communications network as claimed in claim 24, wherein a bandwidth allocation mechanism is used to pre-allocate, on a predictive or as needed basis, capacity within the second-stage Layer 1 constraint-based routed label switched paths such that dynamic multiplexed label switched path selection is deterministic.